OFFICE MEMORANDUM

MICHIGAN
DEPARTMENT OF STATE HIGHWAYS

November 23, 1970

To: L. T. Oehler
Engineer of Research

From: A. J. Permoda

Subject: Plastic Beads for Traffic Paint from Dow Chemical Company. Research Project 68 NM-206. Research Report No. R-757.

Sample of subject beads was received for evaluation through R. L. Greenman in July 1968. Since the beads graded 20 to 60 mesh, which is considered larger than optimum for traffic paint reflectorization, a smaller size bead was requested.

They were subsequently supplied in a 30 to 80 mesh gradation. The supplier stated the beads were composed of polystyrene plastic having about 8 percent divinylbenzene copolymer; having a density of about 1.05 and an Index of Refraction of about 1.6. The price was given as being comparable to glass beads, on a volume basis.

The screening evaluation of the plastic beads as replacements for glass beads on pavement markings was subdivided into the following three tests:

1. In the 1968 Performance Tests, two paints in two areas had plastic beads applied drop-on, in additional stripes.

2. In the Fall 1968 striping of the three-lane US 27 in Lansing, plastic beads were applied on one lane line, while glass beads were applied on the adjoining lane line for comparative purposes for a distance of about two miles.

3. In the laboratory evaluation, draw-downs of a traffic paint were made containing drop-on additions of both plastic and glass beads, duplicating the field-stripe thickness and bead ratio. After drying, these samples were exposed to the weather on the roof of the building, in a horizontal position.

The results of the screening evaluation are listed below, with sequence corresponding to the numbers above:

1. Ratings for transverse performance test lines are given below, as extracted from Research Report No. R-720. The paints were white, with the plastic beaded stripes in only two areas, while the comparative glass beaded stripes were in the standard four. The beading rates were equal on a volume basis.

Alkyd Paint		Epoxy Ester Paint		Reported Factor
Glass	Plastic	Glass	Plastic	
7.6	8.3	6.8	6.4	6 day Nite Visibility
7.2	5.8	7.2	5.6	97 day Nite Visibility
1.1	0.9	1.5	2.2	170 day Nite Visibility
47.7	46.5	52.2	51.7	338 day Service Factor

Comparison of above ratings, realizing the test area variable involved, and accelerated deterioration of test lines due to studded tires, shows that initial night visibility of the plastic beaded stripes was about equal to glass beading, but decreased at a faster rate thereafter. The final Service Factor ratings of the plastic beaded stripes were just slightly lower than for the glass, since apparently better bead retention (durability) partially offset the lower night visibility values (Fig. 1).

2. On the longitudinal lane striping applied on Cedar St (US 27) in Lansing on October 28, 1968, it was noted that the plastic beaded stripes lost a significant amount (more than 50 percent) of their night visibility within three weeks of service, though initially they were rated as equal to the glass beading, applied on an identical volume basis. The trend continued thereafter for a month or two, when the observations were discontinued.

3. The roof exposed draw-downs were not rated for 11 months after exposure, because it was felt the above field exposures lost night visibility due mainly through surface scratching of the plastic by traffic, consequently, the roof panels would not suffer such loss. This was not the case, however, as the plastic beaded stripe, after 11 months of roof exposure, did lose most of its night visibility, accompanied by a noticeable yellowing of the plastic bead: the latter was also noted in the performance stripes, reported above. The loss of night visibility was not due to a static electricity attraction for dust, as washing did not significantly improve this quality in the test stripe.

Conclusions and Recommendations

Subject plastic beads, in the provided material, showed a progressive loss of night visibility when exposed in traffic paints to the weather, whether exposed on the roadway or on the roof. A consequent corollary would have to state that scratching of the comparatively softer surface of the plastic bead by traffic was not the prime cause of this deterioration. Though a progressive yellowing was noted to develop during exposure to the weather, the exact mechanism of the deterioration is not currently known to us, nor to the producer.

Though the plastic beads showed equivalent performance to the standard glass beads when initially applied, they are not recommended for use by the Department because of the above shortcoming.

Cognate Testing

1. Subject producer also submitted the plastic beads to several other Highway Departments, but the results of the tests are not known.

2. In the early 1950's, plain and colored plastic beads were received in the Laboratory for evaluation, but the test records have not been located, and the researchers have retired.

3. In HRB Bulletin 57 (covering 1952 meeting), T. E. Shelburne and co-workers in Virginia reported the performance of some plastic beads and many glass beads for reflectorizing traffic paints. The graphed results can be summarized by their statement, "The plastic beads, while containing a high percentage of the coarser sizes, were the poorest performers in the reflectance readings." The composition of the plastic was not stated.

4. In HRB Highway Research News No. 40 (1970), the NCHRP News Brief on page 50 refers to their report No. 85. In reference to the study covering formed-in-place raised markers with comparatively large beads (about 1/4-in.) the brief states, "Snowplows and studded snow tires took a severe toll of the glass beads, and an immediate result was a study of the possibility of using plastic beads instead of glass."

The complete report, NCHRP No. 85, has not been received yet in the Laboratory for review.

TESTING AND RESEARCH DIVISION

A. J. Pedrola

Supervising Engineer
Materials Research Unit
Research Laboratory Section

AJP:sjt

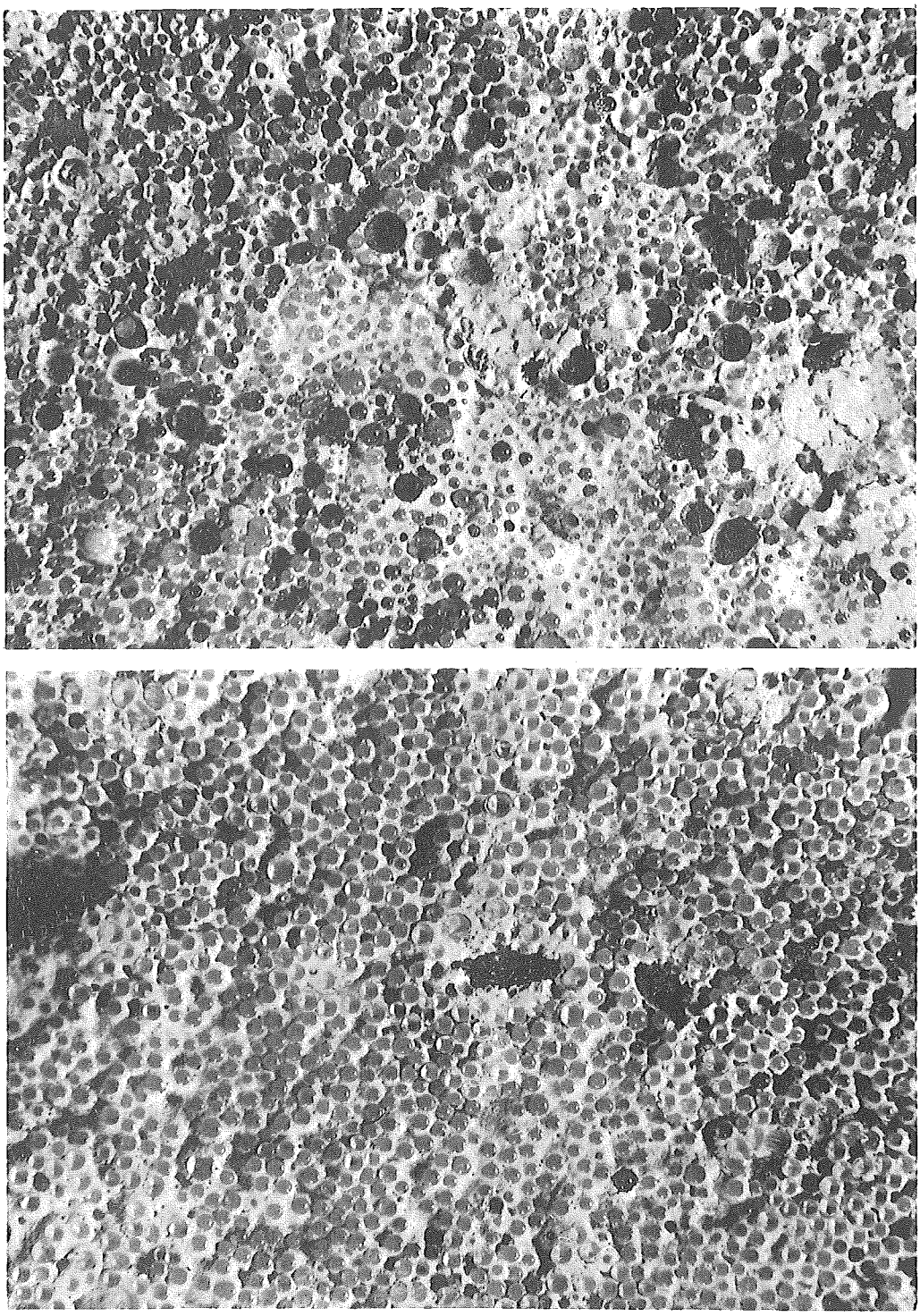

Figure 1. Beading in alkyd white paint stripes on concrete roadway in performance test area after 114 days of service. Specification glass beading (above) shows some black craters where larger beads have been dislodged, and the test plastic beading (below) shows better retention.